PCT/GB98/03501 10/6

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EAJU

Bescheinigung | Certificate | Attestation

Die angehefteten Unterlagen stimmen mit der ursprünglich eingereichten Fassung der auf dem nächsten Blatt bezeichneten europäischen Patentanmeldung überein.

The attached documents are exact copies of the European patent application described on the following page, as originally filed.

Les documents fixés à cette attestation sont conformes à la version initialement déposée de la demande de brevet européen spécifiée à la page suivante.

Patentanmeldung Nr. | Patent application No. | Demande de brevet n°

97309810.6

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
p.o.

H.L. Block

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Blatt 2 der Bescheinigung
Sheet 2 of the certificate
Page 2 de l'attestation

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Application no.: 97309810.6
Demande n°:

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Date de dépôt:

Anmelder:
Applicant(s):
Demandeur(s):
BRITISH TELECOMMUNICATIONS public limited company
London EC1A 7AJ
UNITED KINGDOM

Bezeichnung der Erfindung:
Title of the invention:
Titre de l'invention:
Directory service for a communication network

In Anspruch genommene Priorität(en) / Priority(ies) claimed / Priorité(s) revendiquée(s)

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The original title of the application reads as follows:.
Communications network

Communications Network

The present invention relates to a communications network, and in particular to a network in which customers use a number of different call control mechanisms.

In a conventional public telephone network, customers have only one type of address, namely telephone numbers, and there is a single uniform call control mechanism which is built into the telephone network and which is used for establishing and for terminating calls, and for recognising e.g. when a called party is busy. Increasingly however, customers have access to a range of different network technologies, each with its own address type. For example, a customer might have in addition to a telephone number a conventional IP (Internet Protocol) address, a multicast IP address and a URL (Uniform Resource Locator).

In general, each of these different address types has associated with it a respective call control protocol (where the term "call control" is used broadly to denote the means for establishing and terminating connections between different parties). For example, audio or visual communication between parties using conventional IP addresses commonly uses the H.323 protocol, whereas for communication between IP multicast addresses a different protocol, Session Description Protocol (SDP) is used. Maintaining a one-to-one mapping between address types and call control has the advantage that the user knows unambiguously the appropriate call control mechanism for establishing contact with a particular address. However, as new call control mechanisms have proliferated, and as existing protocols develop to offer new functionality and to harness the capabilities of increasingly sophisticated client terminals and of networks offering more bandwidth, it becomes increasingly difficult to maintain the one-to-one mapping. As a result, it has become difficult to guarantee successful call set-up based simply on knowledge of the address type of the called party.

According to a first aspect of the present ivention, there is provided a method of operating a communications network comprising;

a) for each of a plurality of users connected to the network, registering user profile data in a directory which is accessible to other users, which user

profile data includes identifiers for one or more of a plurality of different call control protocols;

b) prior to establishing a call from a calling party to a called party, reading user profile data for the called party terminal from the directory; and

c) subsequently establishing the call using a call control protocol identified in the said user profile data for the called party.

The present invention makes it possible to dispense with one-to-one mapping of address types and call control protocols, whilst still ensuring that a calling party has all the information necessary for successful call set-up. This is achieved by recording call control capabilities for different users at client terminals in a directory which is accessed by a customer prior to attempting to set up a call. In addition to allowing flexibility in the selection of call control protocols, this arrangement also facilitates customer mobility, since a user can log on at different terminals and update the corresponding user profile accordingly.

Often, the step of registering user profile data will be carried out by the client terminal itself. For example, when the client terminal is a PC connected to a LAN, then the client terminal may register its user profile with the directory each time the user logs onto the LAN. Preferably however the method also provides for the step of registering the client profile to be carried out by a third party. The third party may for example register a conference address and a session control protocol which applies to a multiplicity of parties to a conference.

Preferably the user profile includes at least one network address for a client terminal. Preferably the user profile further comprises network driver or call control identities for each network driver used by the client terminal to access the network. Together these are known as a client capability

Preferably the method includes registering the user profile data when a user at a client terminal logs on to a network; and maintaining a record of the user profile data after the user logs off. Preferably in this case the user profile includes a flag which distinguishes data for persistent terminal capabilities from other data, and only the said data for persistent terminal capabilities are maintained after the user logs off.

Preferably, in the step of registering user profile data, the user profile data is structured as a hierarchy of objects including a user profile parent object and at

least one client capability child object. Preferably the hierarchy of objects further comprises network address objects and call control objects, which network address objects and call control objects are related to the client capability object as child objects to parent object.

The terms object, parent and child are used here and throughout the description and claims with the meanings normally assigned these terms in object oriented design/programming (OOD/OOP).

According to a second aspect of the present invention there is provided a communications system comprising:

a) a network:

b) a multiplicity of client terminals connected to the network, and different ones of the multiplicity of client terminals having different call control capabilities;

c) a directory which is accessible to the multiplicity of client terminals and which is programmed with user profile data for users of the client terminals, which user profile data includes, for each user, identifiers for one or more of a plurality of call control protocols.

The directory may be located entirely on a server which is remote from the client terminals and which is accessed via the network. Alternatively the directory may comprise directory system proxies located locally at respective client terminals and a database which is located remotely from the terminals and which is accessible via the directory system proxies.

Systems and methods embodying the present invention will now be described in further detail, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic of a first network embodying the present invention;

Figure 2 is a first message flow diagram;

Figure 3 is a schematic showing platforms for use in the network of Figure 1;

Figure 4 is a diagram showing a user profile object;

Figures 5a & 5b are diagrams showing alternative LDAP implementations of the invention;

Figure 6 is a second message flow diagram;

Figure 7 is a third message flow diagram;

Figure 8 is a fourth message flow diagram;

Figure 9a, 9b and 9c are diagrams showing classes used in implementing a protocol embodying the invention;

Figure 10 is a diagram showing in further detail classes used in implementing a protocol embodying the invention;

Figure 11 is a schematic showing platforms for use in an alternative embodiment.

In figure 1, a communications network 1 includes user terminals 2, 3 connected to different respective network domains 4,5. In this example, the user terminals 2,3 are computer workstations. The network domains in this example are broadband networks which support both ATM (asynchronous transfer mode) and IP (Internet Protocol) transmission protocols. The first user terminal has both an Internet address (111.111.1.113) and an ATM address (ATM1). Similarly, the second user terminal has an Internet address (123.123.1.124) and an ATM address (ATM2). The network domains are linked by a connection 6 which also supports both of these protocols. A directory platform is linked by an IP data connection 8 to the first network domain 4 and via the first network domain 4 to the second network domain 5. The directory platform has an IP address 321.321.3.321.

In use, customers at user terminals 2,3 both register with a directory server which, in this example, runs on the directory platform 7. Subsequently, as will be further described below, when a customer at user terminal 2 wishes to contact the customer registered at user terminal 3, then a request is submitted to the directory server. This request is transmitted to the IP address of the directory platform 7. The request includes data, such as the customer name, which identifies the called customer. The directory server uses this data to select a corresponding user profile which was created when the customer registered with the directory server. From the selected user profile the directory server returns to the calling customer the network addresses and call control capabilities of the called customer. Using this information the calling customer sets up a call to the other customer. For example, the calling customer in this instance may choose to

establish a connection to the ATM address (ATM2) using the ATM call control protocol (Q.2931).

The steps of the protocol outlined above, which is termed the "heterogeneous directory protocol " (HDP) , will now be described in further detail.

Registering Client Profiles

When registering with the directory server, the client enumerates its network drivers, call control capabilities and network addresses. By way of example, these may include:

A network driver could be an ATM card, a Windows socket API, a telephone line driver.

Call control can be the ISDN series Q.931 or Q.2931, H.323, H.310, PSTN, IP unicast or IP multicast.

The network addresses could be AESA, IP or E.164 Telephone number.

A model of the client's call control capabilities and network address resources is registered with the directory server. The directory server then assumes that the client is registered and that is active. When the client is not active, existing details may be stored on the directory server. The existing details record other methods of making calls or passing messages to the client. These details may include a URL (uniform resource locator), PSTN (public switched telephone network) number or Email address. This static information is updated with any relevant changes notified by the client when the client registers. The URL may be used as a pointer to an HTML page containing details of further special resources, such as a conferencing capability, associated with the user. The HTML page could additionally be used to access Java call control applets. An indication of the nature of these resources may be stored with the URL and made available to other users as part of the user profile.

There are two possible ways of registering client capabilities. The first way is for the client itself to register its own capabilities. Only addresses and

technologies that are associated with the client at the time of registration are permitted to be registered. The second way is to allow clients to register capabilities of clients other than themselves. An example of this would be the advertisement of a conference address and associated call control protocol by a third party. These two methods for registering client capabilities may also be used to update, remove and unregister client capabilities.

The directory server uses an hierarchical model to store the information registered by the client. By traversing the model it is possible to find client details and their associated capabilities. The directory can be accessed by many mechanisms, such as the Internet, B-ISDN's (broadband Integrated Services Digital Network) Generic Functional Protocol and MF4 tones and announcements. Clients access their local directory server using a pre-defined call control protocol and network address, such as TCP and an IP address.

The registration process is illustrated in message sequences 1 and 2 of figure 2. The *RegisterProfileRequest* message is used to indicate to the directory system that the client is now active. In addition, it can inform the directory system of any new capabilities that have become available as a result of the client becoming active. On receipt of the *RegisterProfileRequest* message the directory system authenticates the client and any associated request. Assuming the request is valid, the directory system updates itself and sends a *RegisterProfileResponse* back to the client.

Modifying Client Profiles

While the client remains active it may add, modify or remove client capabilities stored on the directory system. This may be necessary, for example, if the client obtains new call control technology or a new network address. The *UpdateProfileRequest* message, shown in message sequences 3 & 4 in Figure 2, is used to add or modify client capabilities. The parameters passed in this message determine whether a new client capability is added to the directory system or an existing client capability on the directory system is modified. In this implementation, the address and call control fields form the client capability primary key for the directory system. Hence, if both the address and call control parameters passed in the *UpdateProfileRequest* message match an existing client

capability primary key in the directory system the message is used to modify other parameters belonging to that client capability. If no match is found, the message is used to create a new client capability in the directory system. Again, assuming the request is valid, the directory system updates itself and sends a *UpdateProfileResponse* back to the client.

The *RemoveProfileRequest* message, shown in message sequences 5 & 6 in Figure 2, is used to remove client capabilities from the directory system. If both the address and call control parameters passed in the *RemoveProfileRequest* message match an existing client capability primary key in the directory system, then the matched client capability is deleted from the directory system. If no match is made an error is assumed, the result of which error or otherwise is returned to the client using the *RemoveProfileResponse* message.

Unregistering Client Profiles

When a client becomes idle, for example when a user logs off his/her office computer, the client undergoes the unregistration procedure illustrated in message sequences 13 and 14 of Figure 2. The *UnregisterProfileRequest* message is used to indicate to the directory system that the client has moved from the active state to idle. On receipt of this message the directory system authenticates the client and assuming the request is valid, the directory system updates itself and sends a *UnregisterProfileResponse* back to the client. As part of the directory system update, all client capabilities indicated as not being persistent are removed from the directory. Other client capabilities such as Email accounts and URLs, which do not need call control, are maintained on the directory.

Searching for Client Profiles

The client first accesses the network directory using a search criteria such as familiar name, e-mail address or URL. The directory returns a set of information containing addresses and call control capabilities, etc. that match the search criteria. The search procedure is illustrated in message sequences 9 and 10 of Figure 2. The *SearchProfileRequest* message can be used to pass parameters such as the client's distinguished name, the client's domain name and/or the client's

familiar name. At least one of these parameters must be passed to the directory system. On receipt of the request, the directory system searches for clients that match all the parameters passed to it. All matched clients are indicated to the remote client using the *SearchProfileResponse* message. In addition to the list of matches passed to the remote client, a summary for each matched client is also sent back.

This procedure can be used regardless of whether the clients being searched for are active (registered) or not (unregistered).

Getting Client Capabilities

By passing a unique identifier to the directory system, the capabilities of the client identified are returned to the requesting client. All global client capabilities are returned. Non-global client capabilities are returned only if the requesting client belongs to the same domain as the client whose details are being requested. The client then chooses an appropriate call control method to initiate the call.

This procedure is shown in message sequences 11 and 12 of Figure 2. The *GetClientCapabilityRequest* message is sent to the directory system. It contains the client's distinguished name and the client's domain name. These two parameters uniquely define the client. Assuming this client is stored in the directory system, the list of client capabilities for this client is passed to the remote client in the *GetClientCapabilityResponse* message.

This procedure can be used regardless of whether the client being scrutinised is active (registered) or not (unregistered).

Figure 3 shows schematically the principal components of a system implementing the above protocol. The protocol is implemented across the interface referenced A, between a client terminal 31 and a directory server 32. The client in this example is a personal computer which includes an ATM driver 311 and an IP driver 312. Within the directory server 32, the data supplied by clients as they register is stored as a structured hierarchy of objects. The parent

object corresponds to the user profile. There is associated with each user profile one or more client capability objects. Each client capability object has child objects including an address object and a call control object. Although in the diagram only a single instance of each object is shown, in reality the directory server includes many user profile objects, and each user profile may contain several client capabilities. A management server 34 also has access to the directory via the interface A. The management server 34 may be used, for example, to change the values of addresses in certain user profiles so that the routing adopted to a particular user varies according to the time of day. Alternatively, time-dependent settings may be specified directly by the user. In either case, this facility may be used, for example, to set a network address value to correspond to an office-based terminal during office hours, and subsequently to a home terminal outside office hours. The management server may also modify address values stored in user profiles in response to a network failure. This then prevents congestion from unsuccessful call attempts.

The objects referred to above determine how the data is registered, modified or accessed. In this implementation the data is stored in an LDAP (Lightweight Database Access Protocol) directory. LDAP is used across the interface referenced B in the Figure. LDAP is a flexible system for storing any flat data within a Data Information Base (DIB). The classes used to implement the present invention are at some time read from, written to and modified within an LDAP DIB. The DIB does not replicate class formats directly but it can store records in relative order and provide identifiers. For instance, when an address record is retrieved from the DIB, the address type can be queried to find for example that the class is an AESA Address. An empty AESA class can then be populated with the data. Likewise, when a class is to be written to the DIB, the class type will cause an identifier to be set in the DIB record for example that a record is a CallControl Q.2931 subclass.

Figure 4 is a simple schematic for storing user profile, client capabilities, addresses and call controls. For example, an organisation such as BT may publish all its user profiles under the distinguished name (dn) of userProfiles.boat.bt.com. To perform an LDAP search to retrieve "John Smith" UserProfile the base object to begin the search would be "userProfiles.boat.bt.com", with a filter specifying

either the userName "smithj" or familiarName "John Smith". The search would return matching UserProfiles. The summary text is examined by the user to identify the correct record. Once the UserProfile record is identified, the directory implementation can then perform a search for client capabilities using the base object "smithj.userProfiles", which will return a list of ClientCapabilities records. Searches can then be performed using "Client_Cap_1", "Client_Cap_2" etc., as the base object to extract Address and CallControl Objects.

Table 1 below lists LDAP records used to implement the invention.

Table 1

Class	LDAP Record
UserProfile	familiarName : String distinguishedName : String domainName : String summary : String password : String
ClientCapability	persistance : boolean globalAccess : boolean
Address	addressType : Integer = 0
IP	addressType : Integer = 1 version : String
Multicast	addressType : Integer = 2 version : String timeToLive : Integer
Unicast	addressType : Integer = 3 version : String
E164	addressType : Integer = 4 version : String
AESA	addressType : Integer = 5 version : String type : String
CallControl	callControlType : Integer = 0 version : String
H225	callControlType : Integer = 1 version : String
SDP	callControlType : Integer = 2 version : String
BISDN	callControlType : Integer = 3 version : String
ATMFUNI	callControlType : Integer = 4

	version : String
Q2931	**callControlType : Integer = 5** **version : String**
Q2971	**callControlType : Integer = 6** **version : String**
NISDN	**callControlType : Integer = 7** **version : String**
Q931	**callControlType : Integer = 8** **version : String**
PSTN	**callControlType : Integer = 9** **version : String**
BTNR315	**callControlType : Integer = 10** **version : String**

Figures 5a and 5b show alternative approaches to constructing an LDAP implementation. Figure 5a uses a local directory system proxy. In this system, a directory system object (DS) exists on the client. When the client object communicates with the directory it uses a standard Application Programmers Interface (API), examples ranging from C and Java to remote procedure calls. The directory class then acts as a proxy converting the protocol messages such as RegisterProfile and SearchProfile into LDAP messages. The LDAP messages are then sent using Internet Protocol via a LAN to the LDAP server, where they are applied and responded to.

One benefit of this approach is that all operations can be performed on a standardised LDAP address and port number. To implement the system only the client application needs to be updated, whilst on the LDAP server, only the database needs populating.

The approach illustrated in Figure 5b uses a remote directory system proxy. In this system the client object communicates with the Remote Directory System Proxy using the HDP protocol of the present invention over either a Remote Procedure Call (RPC) for C interface or Remote Method Invocation (RMI) for Java interface. The client object must know the IP address and port to send the requests to. It must also register a port for receiving responses. The remote

directory server then converts the HDP protocol as described above with reference to Figure 2 into LDAP messages. In this approach, the Directory Server and LDAP server may run on a single platform, or alternatively may each have a dedicated platform.

Figures 6, 7 and 8 show LDAP and HDP message flow protocols for an LDAP implementation of the invention. Figure 6 relates to the registering/unregistering of a profile; Figure 7 shows the updating of a user profile and Figure 8 shows the message flows when a client requests a user profile for a called party in order to set up a call.

Figures 9a, 9b, 9c and 10 show classes representing the principal components used in implementing the invention. The diagrams are generated using the Rational ROSE (Rational Object-oriented Software Engineering) software tool, which is available commercially from Rational Software Corp. of Santa Clara, California. Using that tool the class structures shown can be compiled to generate code templates for use in implementing the HDP protocol. All that the programmer would then need to do is to create state diagrams from the message flows and add the appropriate state transitions to the code. Alternatively, equivalent features may be programmed using any one of a number of suitable programming languages, such as Java or C++, well known in this field. The client class shown in Figure 9a models the local client terminal and the access from that terminal to the directory system. It represents capabilities which are local to the client terminal. The directory class represents the directory server. This class may be inherited and specialised to allow implementations using different proprietary data interfaces, such as LDAP in the implementations discussed above, or HTTP in the implementation described below. Figure 9b shows the directory implementation as an aggregation of directory and the relationship between the directory implementation and the LDAP directory. Figure 9c shows the user profile and client capability classes in addition to the directory and client classes. The user profile captures the user's details, as previously described.. A User Profile may have many client capabilities. The Client Capabilities have two additional fields, those of Persistence and Global Access. Persistence allows a Client Capability to be marked such that when a user logs off a machine, it may remain within the directory system. Most local capabilities are set to be non-persistent, examples of persistent capabilities are those of email address or mobile phone number. Global Access

allows a Client Capability to be marked such that clients belonging to a different domain may access it using the Get Client Capability procedure. Figure 10 shows in further detail objects derived from the Client Capability class. The client capability object represents the aggregation of network address and call control capabilities, both of which are ultimately associated, e.g. E.164 address and Q2931 call control. The invention may be implemented using interfaces other than LDAP. Figure 11 shows an embodiment in which the HTTP and CGI are used to provide an interface implementing the HDP protocol. To allow a user to perform the functions within the protocol a home page is defined with buttons and CGI scripts as a front end to the directory system 112. The CGI scripts access a database 113 implemented using commercially available database tools such as ORACLE (trademark) in combination with a web server such as ORACLE Web Server (trademark). Via this interface a user running an HTTP client on a terminal 111 can register name, password and associated client capabilities, make changes to the profile and finally unregister at the end of their session . As in the previously described embodiments, a management server 114 may also access the database.

CLAIMS

1. A method of operating a communications network comprising;

a) for each of a plurality of users connected to the network, registering user profile data in a directory which is accessible to other users, which user profile data includes identifiers for one or more of a plurality of different call control protocols;

b) prior to establishing a call from a calling party to a called party, reading user profile data for the called party terminal from the directory; and

c) subsequently establishing the call using a call control protocol identified in the said user profile data for the called party.

2. A method according to claim 1, in which the user profile data includes at least one network address for a client terminal.

3. A method according to claim 1 or 2, in which the user profile data further comprises network call control identities for each network driver used by a client to access the network.

4. A method according to any one of the preceding claims including:

registering the user profile data when a user at a client terminal logs on to a network; and

maintaining a record of profile data after the user logs off.

5. A method according to claim 4, in which the user profile includes a flag which distinguishes data for persistent user capabilities from other data, and only the said data for persistent user capabilities are maintained after the user logs off.

6. A method according to any one of the preceding claims in which in the step of registering user profile data, the user profile data is structured as a hierarchy of objects including a user profile parent object and at least one client capability child object.

7. A method according to claim 6, in which the hierarchy of objects further comprises network address objects and call control objects, which network address objects and call control objects are related to the client capability object as child objects to parent object.

8. A method according to any one of the preceding claims, including returning different user profile data for a called party depending on the time of day.

9. A communications system comprising:

a) a network:

b) a multiplicity of client terminals connected to the network, and different ones of the multiplicity of client terminals having different call control capabilities;

c) a directory which is accessible to the multiplicity of client terminals and which is programmed with user profile data for users of the client terminals, which user profile data includes, for each user, identifiers for one or more of a plurality of call control protocols.

10. A system according to claim 9, in which the directory is located entirely on a server which is remote from the client terminals and which is accessed via the network.

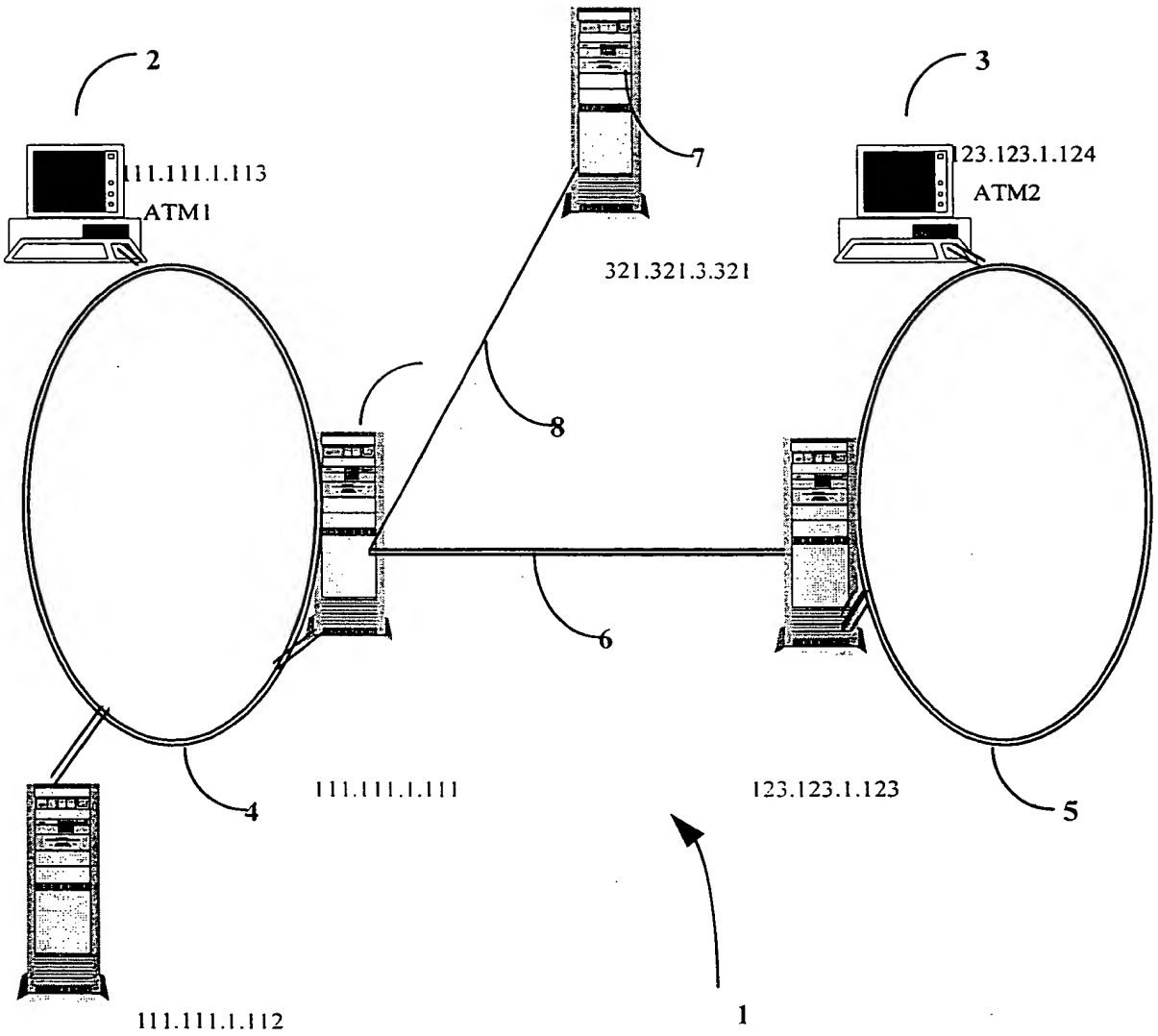
11. A system according to claim 9, in which the directory comprises directory system proxies located locally at respective client terminals and a database which is located remotely from the terminals and which is accessible via the directory system proxies.

12. A system according to any one of claims 9 to 11, in which the directory includes both call control protocol identifiers and network addresses.

Abstract

In a communications network, each of a number of users registers user profile data in a directory. The directory is available to other users. The user profile data includes identifiers for one or more of a plurality of call control protocols. Prior to establishing a call, a user retrieves user profile data for the called party from the directory. The call is then established using a call control protocol which was identified in the relevant user profile.

Figure 1


2
111.111.1.113
ATM1
7
321.321.3.321
3
123.123.1.124
ATM2
8
6
4
111.111.1.111
123.123.1.123
5
111.111.1.112
1

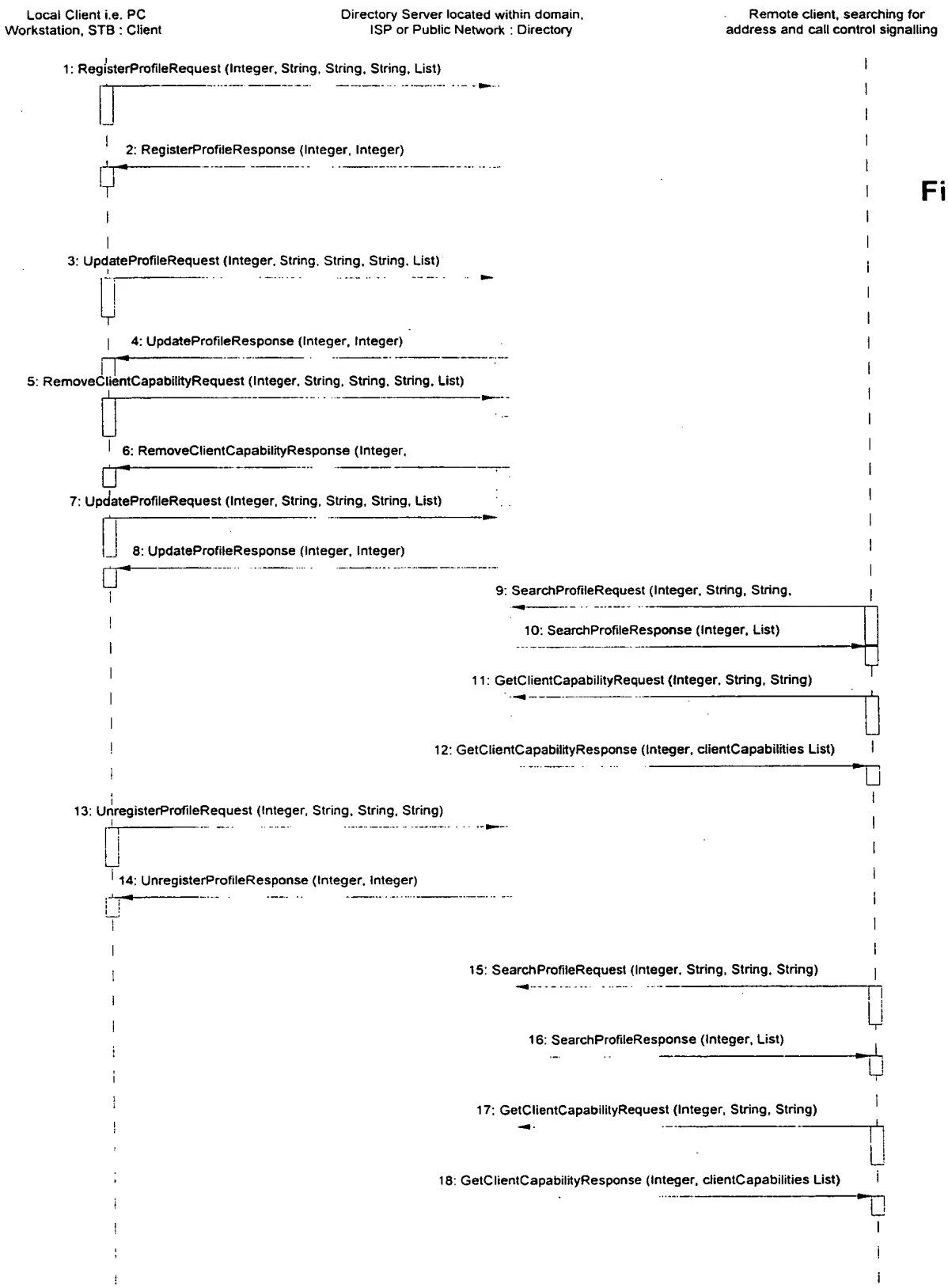

Local Client i.e. PC Workstation, STB : Client
Directory Server located within domain, ISP or Public Network : Directory
Remote client, searching for address and call control signalling
1: RegisterProfileRequest (Integer, String, String, String, List)
2: RegisterProfileResponse (Integer, Integer)
3: UpdateProfileRequest (Integer, String, String, String, List)
4: UpdateProfileResponse (Integer, Integer)
5: RemoveClientCapabilityRequest (Integer, String, String, String, List)
6: RemoveClientCapabilityResponse (Integer,
7: UpdateProfileRequest (Integer, String, String, String, List)
8: UpdateProfileResponse (Integer, Integer)
9: SearchProfileRequest (Integer, String, String,
10: SearchProfileResponse (Integer, List)
11: GetClientCapabilityRequest (Integer, String, String)
12: GetClientCapabilityResponse (Integer, clientCapabilities List)
13: UnregisterProfileRequest (Integer, String, String, String)
14: UnregisterProfileResponse (Integer, Integer)
15: SearchProfileRequest (Integer, String, String, String)
16: SearchProfileResponse (Integer, List)
17: GetClientCapabilityRequest (Integer, String, String)
18: GetClientCapabilityResponse (Integer, clientCapabilities List)

Figure 2

Figure 3

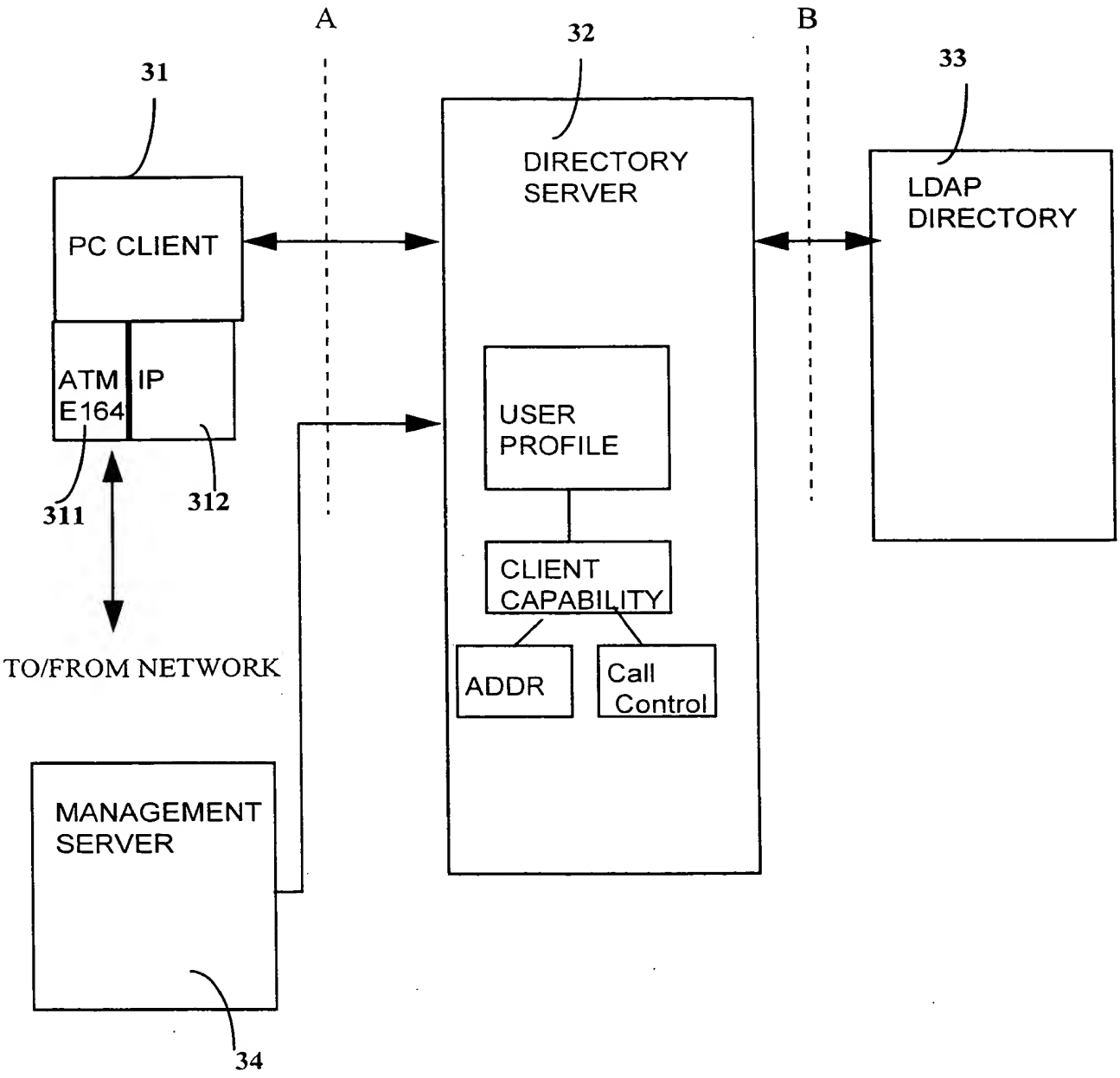
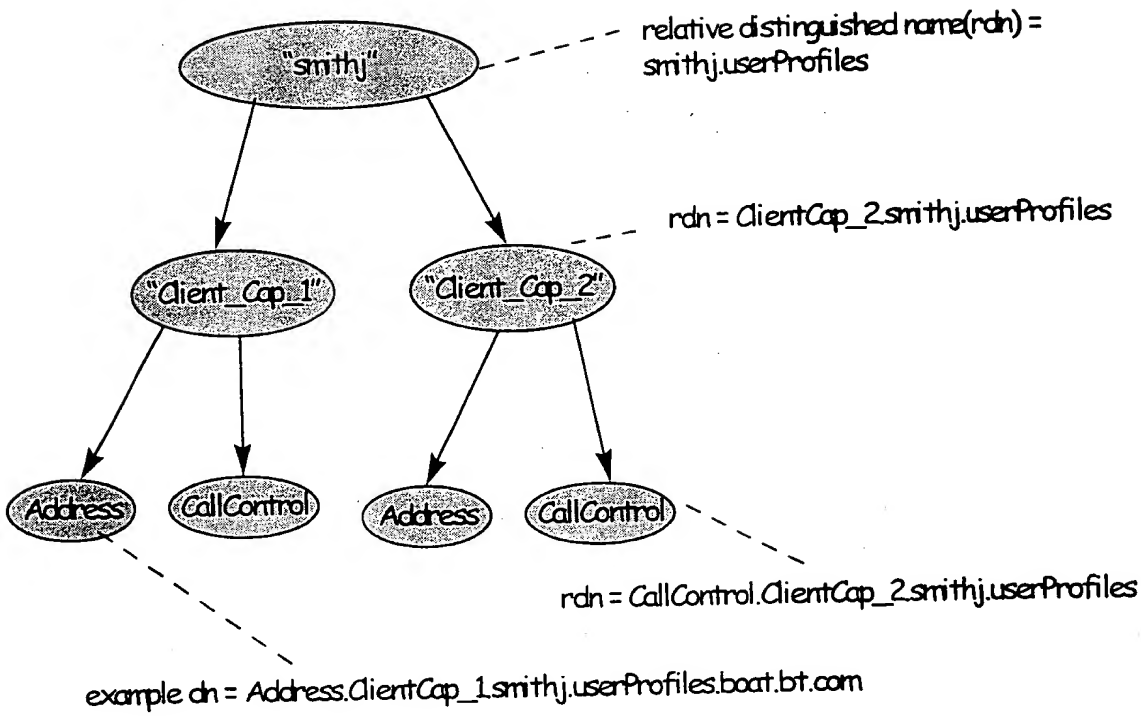

A
B
31
32
33
PC CLIENT
ATM
E164
IP
311
312
TO/FROM NETWORK
DIRECTORY
SERVER
USER
PROFILE
CLIENT
CAPABILITY
ADDR
Call
Control
LDAP
DIRECTORY
MANAGEMENT
SERVER
34

Figure 4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smithj.userProfiles
rdn = ClientCap_2.smithj.userProfiles
"Client_Cap_1"
"Client_Cap_2"
Address
CallControl
Address
CallControl
rdn = CallControl.ClientCap_2.smithj.userProfiles
example dn = Address.ClientCap_1.smithj.userProfiles.boat.bt.com

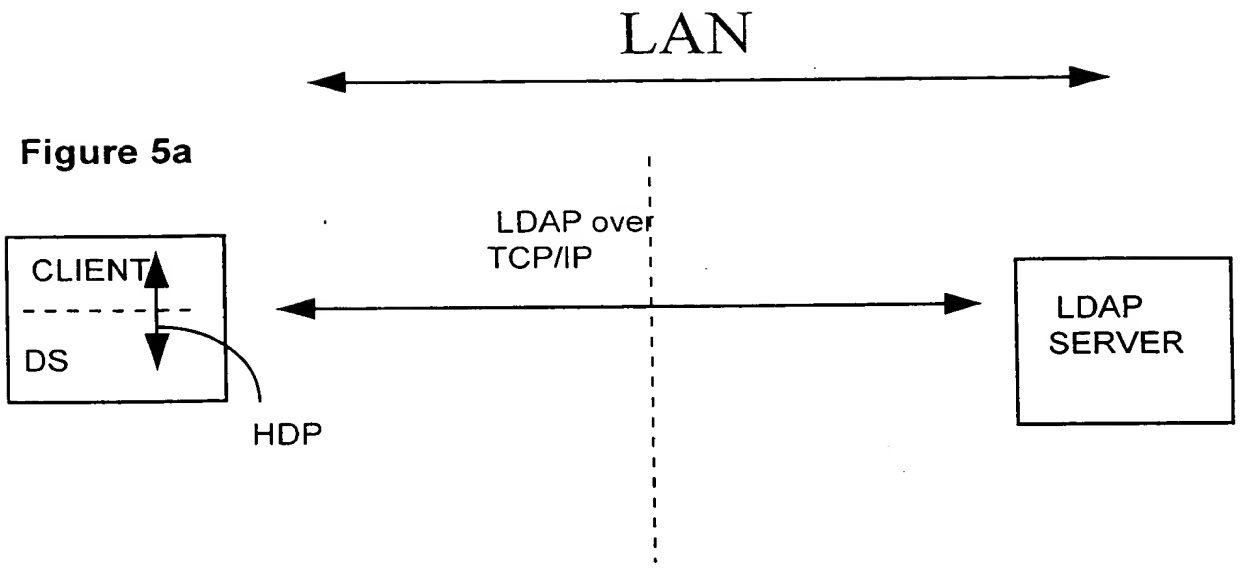


Figure 5a

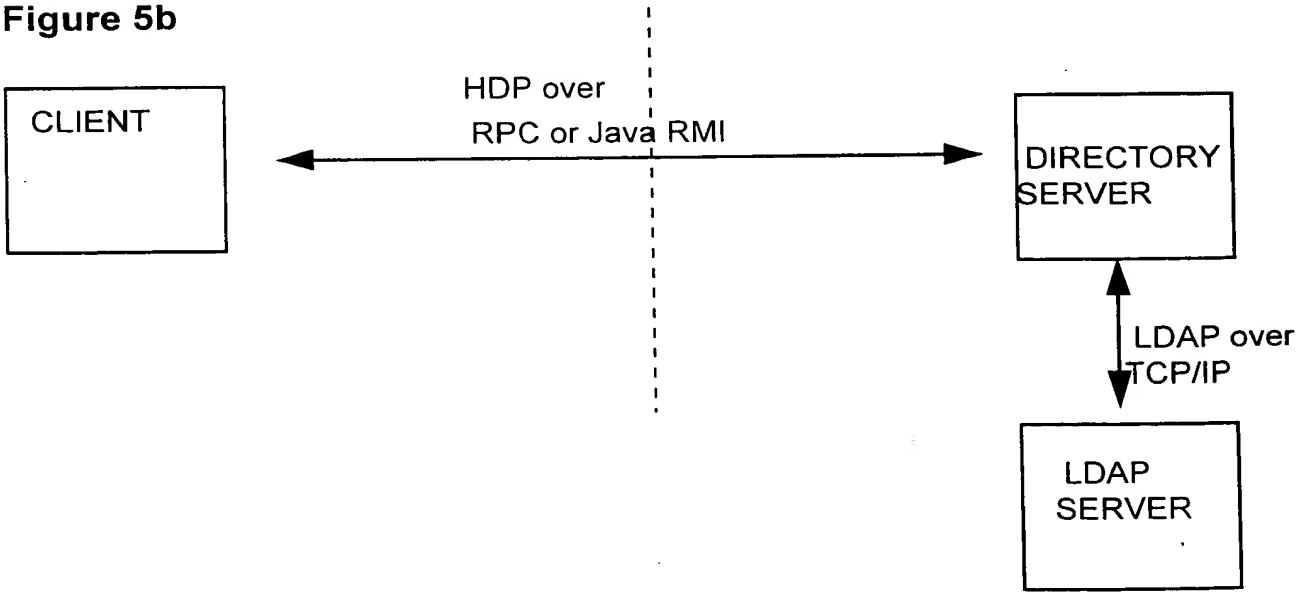


Figure 5b

Figure 6

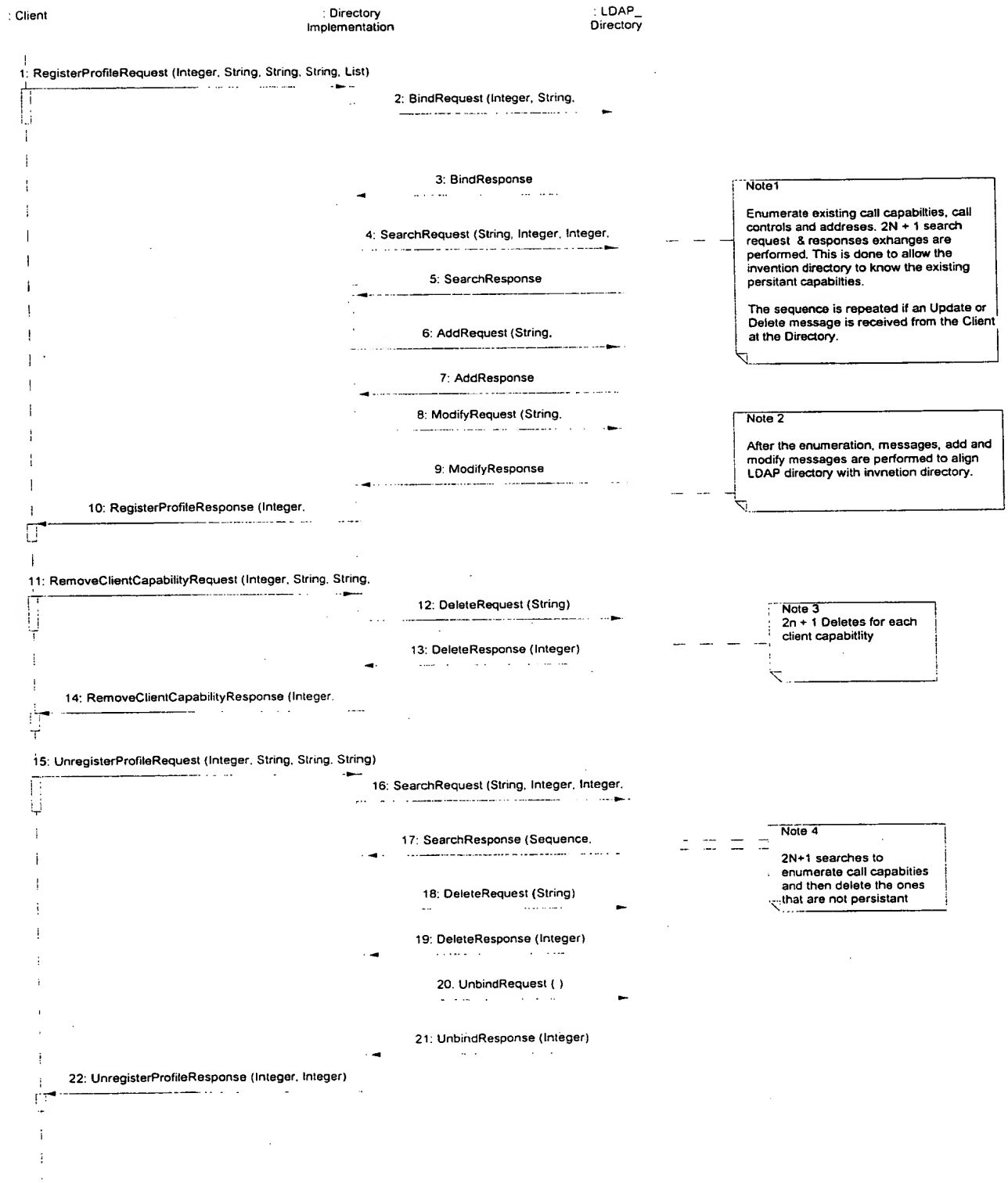

: Client
: Directory Implementation
: LDAP_ Directory
1: RegisterProfileRequest (Integer, String, String, String, List)
2: BindRequest (Integer, String,
3: BindResponse
4: SearchRequest (String, Integer, Integer,
5: SearchResponse
6: AddRequest (String,
7: AddResponse
8: ModifyRequest (String,
9: ModifyResponse
10: RegisterProfileResponse (Integer,
11: RemoveClientCapabilityRequest (Integer, String, String,
12: DeleteRequest (String)
13: DeleteResponse (Integer)
14: RemoveClientCapabilityResponse (Integer,
15: UnregisterProfileRequest (Integer, String, String, String)
16: SearchRequest (String, Integer, Integer,
17: SearchResponse (Sequence,
18: DeleteRequest (String)
19: DeleteResponse (Integer)
20. UnbindRequest ( )
21: UnbindResponse (Integer)
22: UnregisterProfileResponse (Integer, Integer)
Note1
Enumerate existing call capabilties, call controls and addreses. 2N + 1 search request & responses exhanges are performed. This is done to allow the invention directory to know the existing persitant capabilties.
The sequence is repeated if an Update or Delete message is received from the Client at the Directory.
Note 2
After the enumeration, messages, add and modify messages are performed to align LDAP directory with invnetion directory.
Note 3
2n + 1 Deletes for each client capabitlity
Note 4
2N+1 searches to enumerate call capabities and then delete the ones that are not persistant

Figure 7

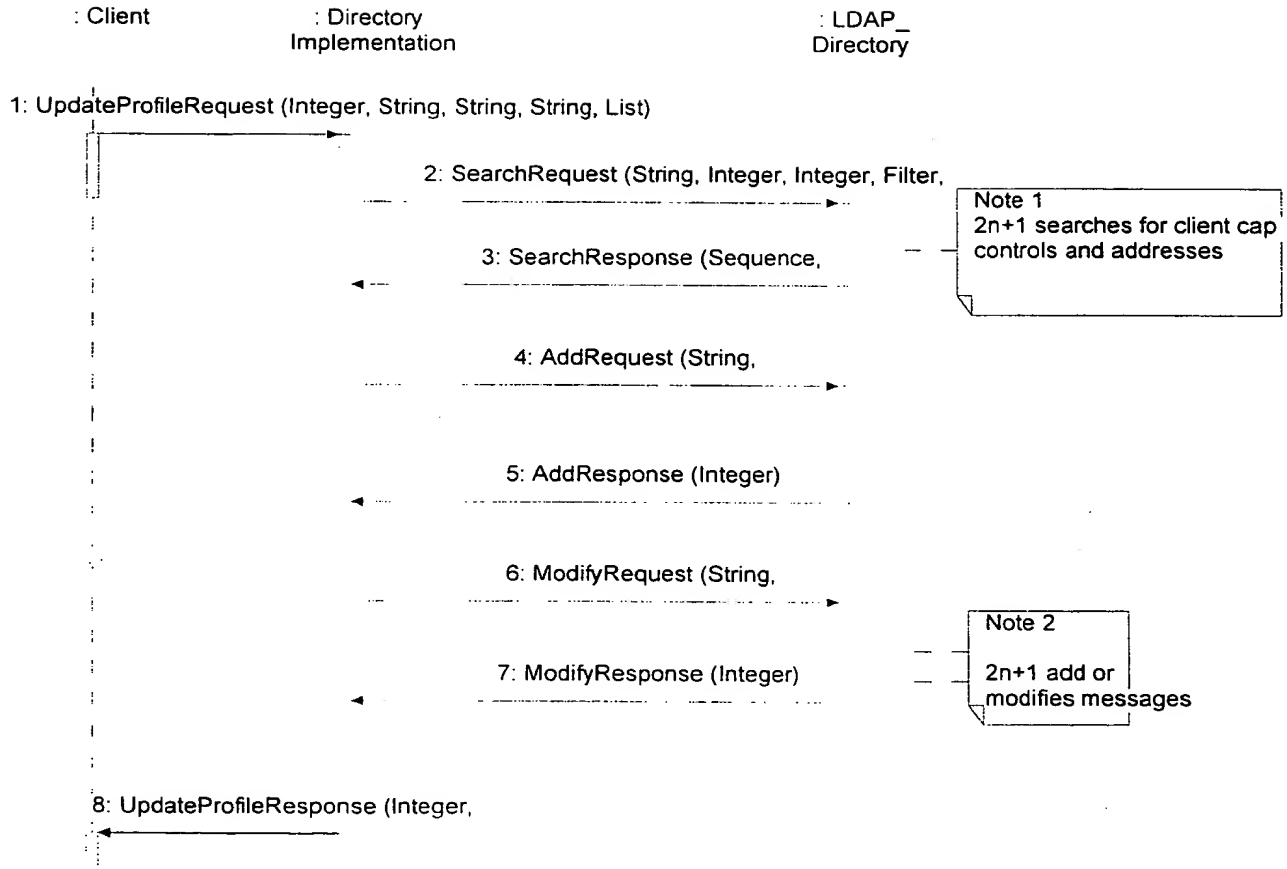

: Client
: Directory Implementation
: LDAP_ Directory
1: UpdateProfileRequest (Integer, String, String, String, List)
2: SearchRequest (String, Integer, Integer, Filter,
3: SearchResponse (Sequence,
Note 1
2n+1 searches for client cap controls and addresses
4: AddRequest (String,
5: AddResponse (Integer)
6: ModifyRequest (String,
7: ModifyResponse (Integer)
Note 2
2n+1 add or modifies messages
8: UpdateProfileResponse (Integer,

Figure 8

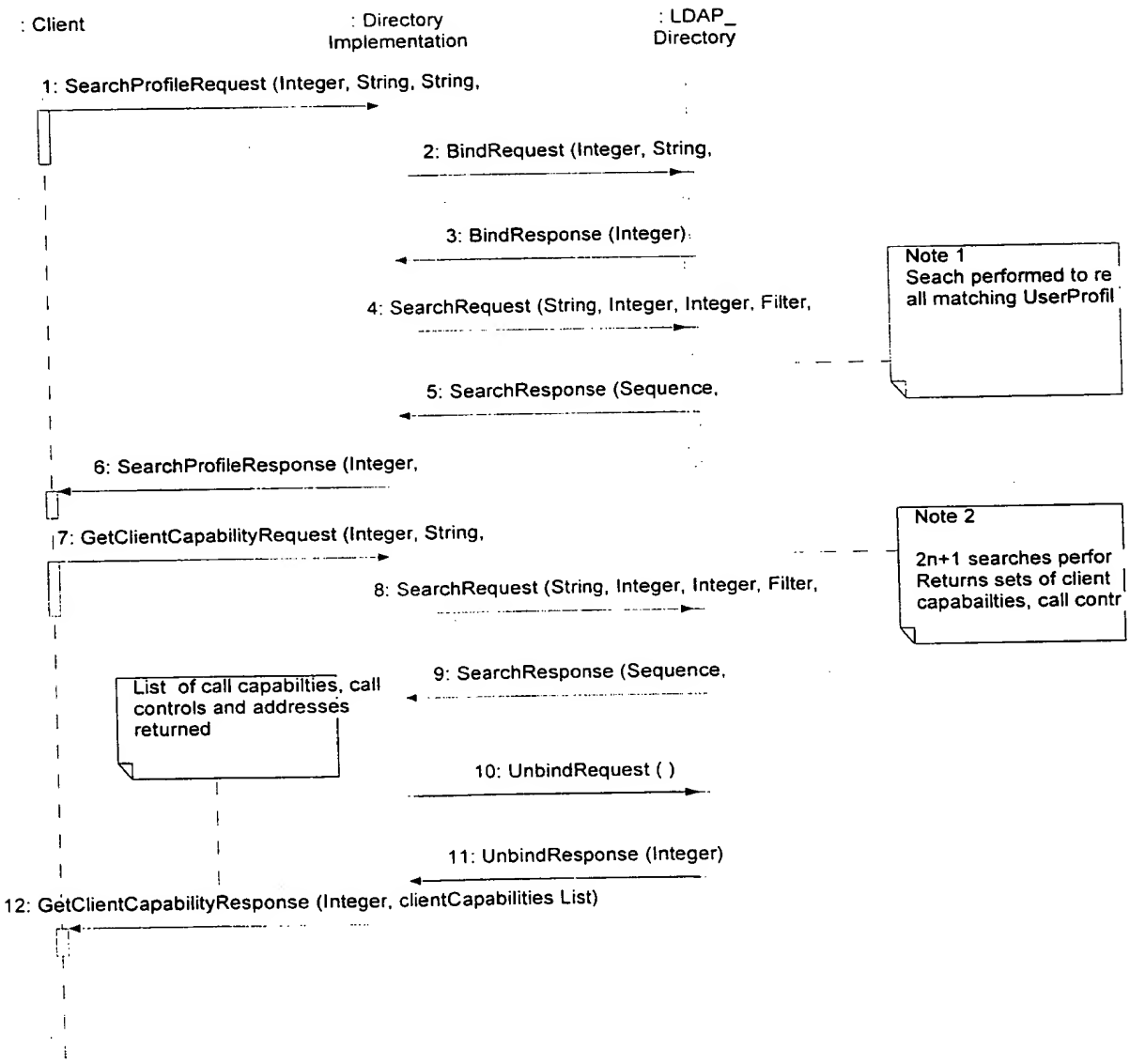

: Client
: Directory Implementation
: LDAP_ Directory
1: SearchProfileRequest (Integer, String, String,
2: BindRequest (Integer, String,
3: BindResponse (Integer)
4: SearchRequest (String, Integer, Integer, Filter,
Note 1
Seach performed to re
all matching UserProfil
5: SearchResponse (Sequence,
6: SearchProfileResponse (Integer,
7: GetClientCapabilityRequest (Integer, String,
Note 2
2n+1 searches perfor
Returns sets of client
capabailties, call contr
8: SearchRequest (String, Integer, Integer, Filter,
9: SearchResponse (Sequence,
List of call capabilties, call controls and addresses returned
10: UnbindRequest ( )
11: UnbindResponse (Integer)
12: GetClientCapabilityResponse (Integer, clientCapabilities List)

Figure 9a

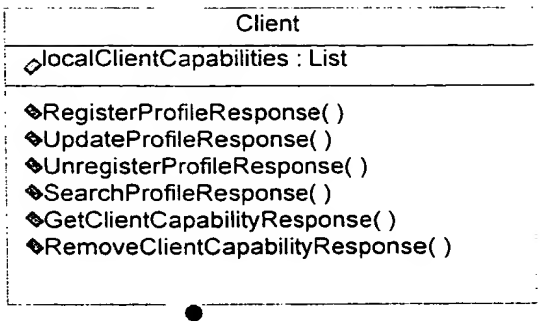


Figure 9b

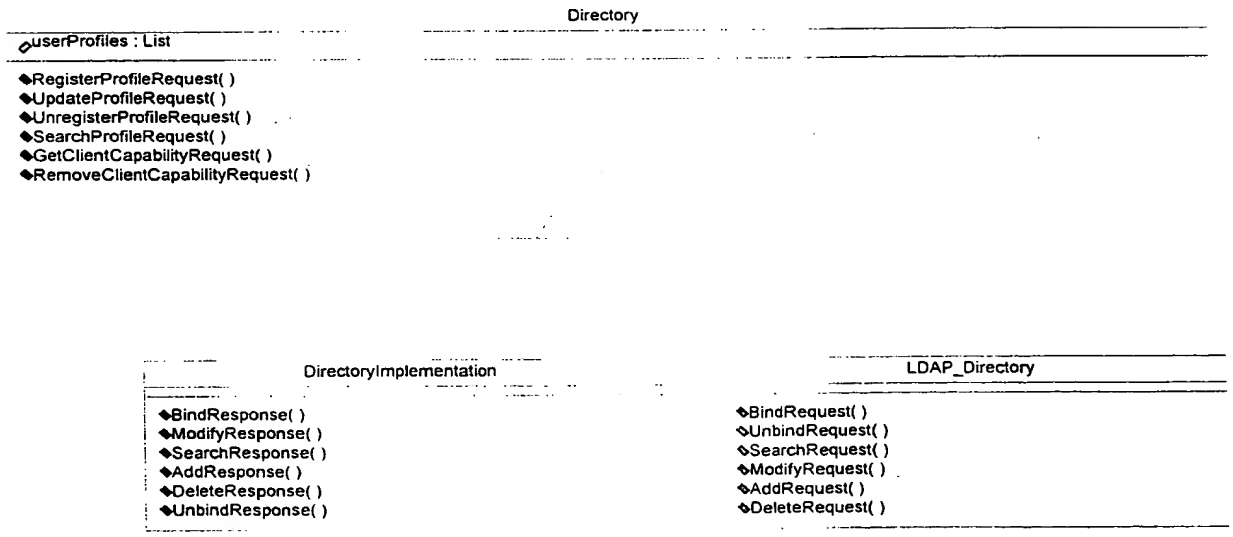


Figure 9c

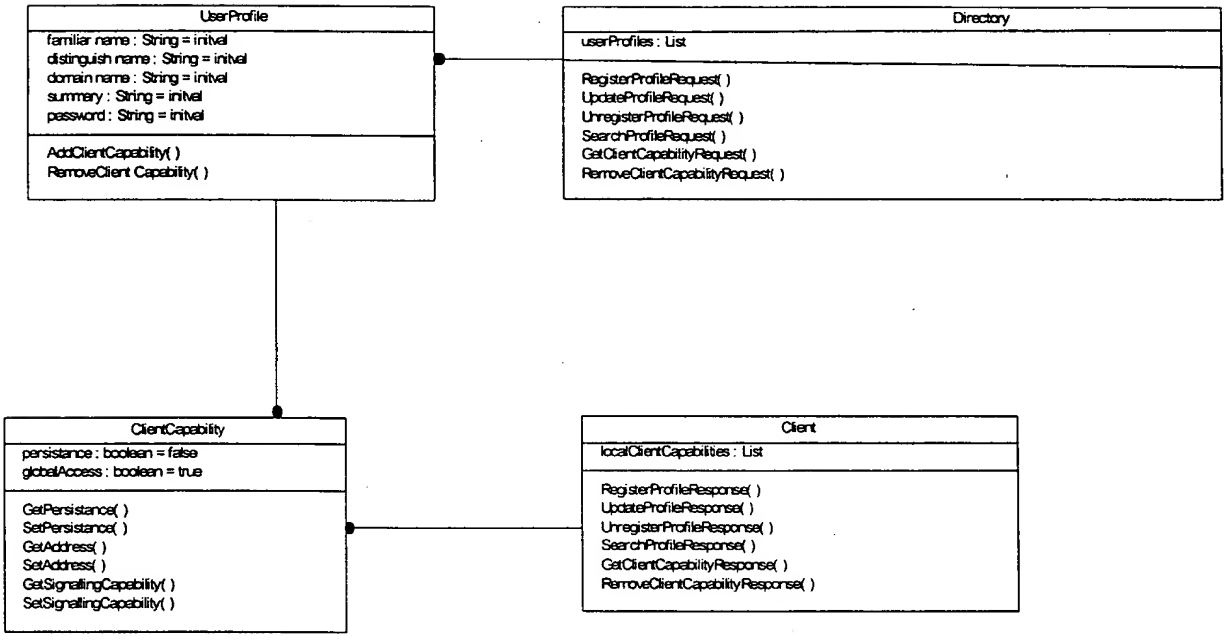

UserProfile
familiar name : String = initval
distinguish name : String = initval
domain name : String = initval
summary : String = initval
password : String = initval
AddClientCapability( )
RemoveClient Capability( )
Directory
userProfiles : List
RegisterProfileRequest( )
UpdateProfileRequest( )
UnregisterProfileRequest( )
SearchProfileRequest( )
GetClientCapabilityRequest( )
RemoveClientCapabilityRequest( )
ClientCapability
persistance : boolean = false
globalAccess : boolean = true
GetPersistance( )
SetPersistance( )
GetAddress( )
SetAddress( )
GetSignallingCapability( )
SetSignallingCapability( )
Client
localClientCapabilities : List
RegisterProfileResponse( )
UpdateProfileResponse( )
UnregisterProfileResponse( )
SearchProfileResponse( )
GetClientCapabilityResponse( )
RemoveClientCapabilityResponse( )

Figure 10

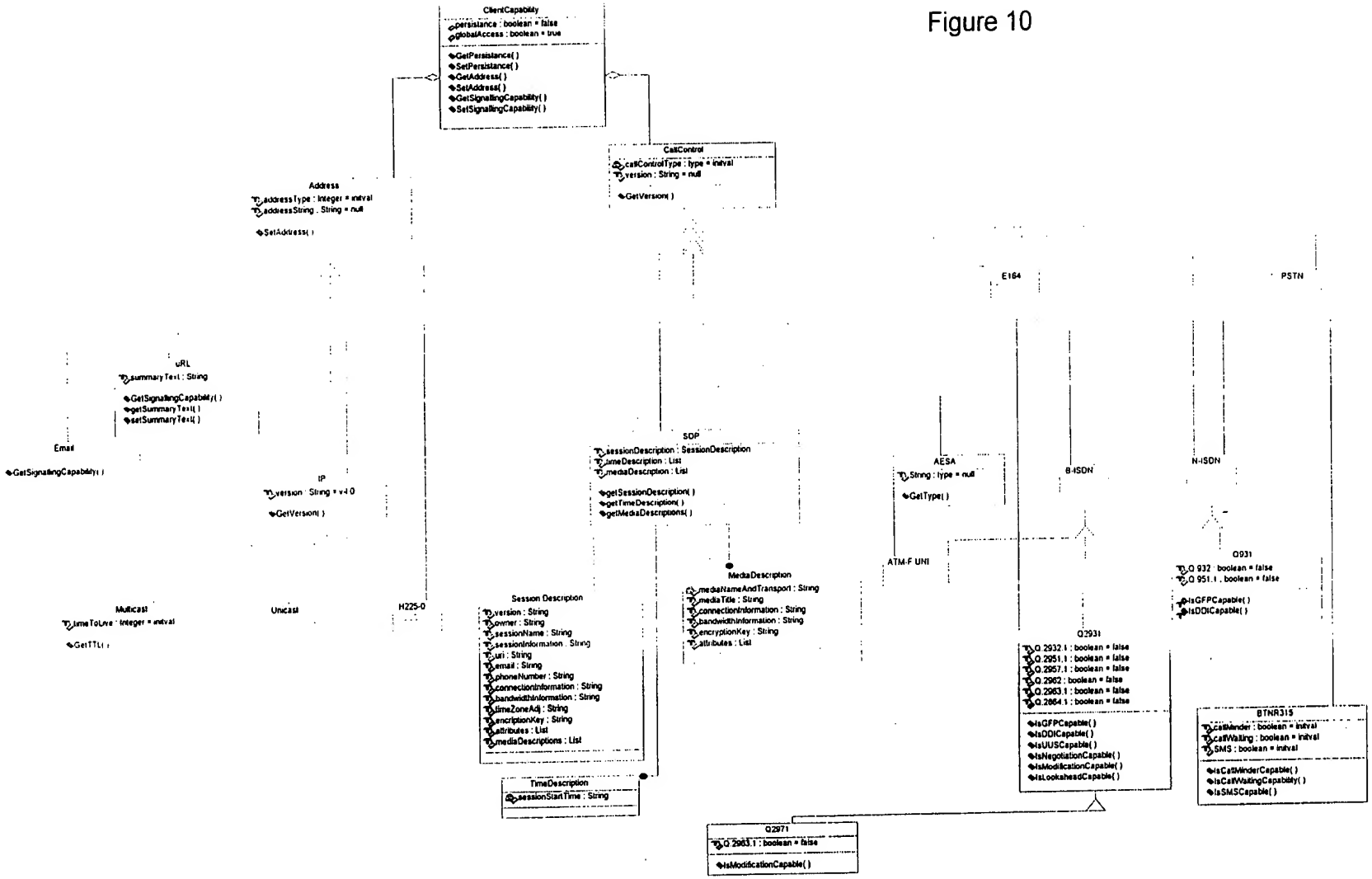
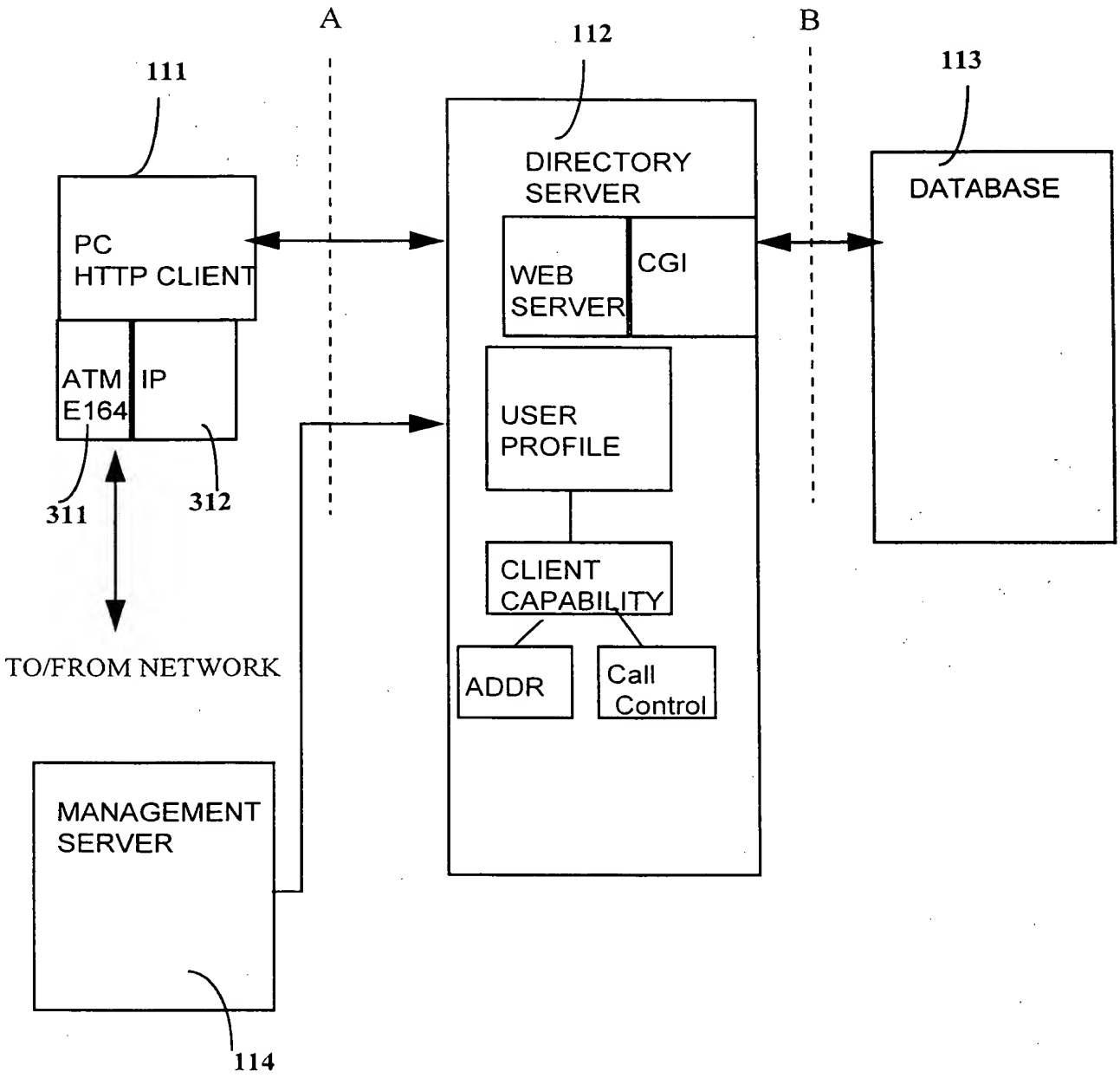

ClientCapability
persistance : boolean = false
globalAccess : boolean = true
GetPersistance( )
SetPersistance( )
GetAddress( )
SetAddress( )
GetSignallingCapability( )
SetSignallingCapability( )
CallControl
callControlType : type = intval
version : String = null
GetVersion( )
Address
addressType : Integer = intval
addressString : String = null
SetAddress( )
URL
summaryText : String
GetSignallingCapability( )
getSummaryText( )
setSummaryText( )
Email
GetSignallingCapability( )
IP
version : String = v4.0
GetVersion( )
Multicast
timeToLive : Integer = intval
GetTTL( )
Unicast
H225-0
SDP
sessionDescription : SessionDescription
timeDescription : List
mediaDescription : List
getSessionDescription( )
getTimeDescription( )
getMediaDescriptions( )
Sesson Description
version : String
owner : String
sessionName : String
sessionInformation : String
uri : String
email : String
phoneNumber : String
connectionInformation : String
bandwidthInformation : String
timeZoneAdj : String
encriptionKey : String
attributes : List
mediaDescriptions : List
MediaDescription
mediaNameAndTransport : String
mediaTitle : String
connectionInformation : String
bandwidthInformation : String
encryptionKey : String
attributes : List
TimeDescription
sessionStartTime : String
E164
AESA
String : type = null
GetType( )
ATM-F UNI
B-ISDN
Q2931
Q.2932.1 : boolean = false
Q.2951.1 : boolean = false
Q.2957.1 : boolean = false
Q.2962 : boolean = false
Q.2963.1 : boolean = false
Q.2964.1 : boolean = false
IsGFPCapable( )
IsDDICapable( )
IsUUSCapable( )
IsNegotiationCapable( )
IsModificationCapable( )
IsLookaheadCapable( )
Q2971
Q.2963.1 : boolean = false
IsModificationCapable( )
PSTN
N-ISDN
Q931
Q.932 : boolean = false
Q.951.1 : boolean = false
IsGFPCapable( )
IsDDICapable( )
BTNR315
callMinder : boolean = intval
callWaiting : boolean = intval
SMS : boolean = intval
IsCallMinderCapable( )
IsCallWaitingCapability( )
IsSMSCapable( )

Figure 11


A
B
111
112
113
DIRECTORY SERVER
DATABASE
PC HTTP CLIENT
WEB SERVER
CGI
ATM E164
IP
USER PROFILE
311
312
CLIENT CAPABILITY
TO/FROM NETWORK
ADDR
Call Control
MANAGEMENT SERVER
114